## REMARKS/ARGUMENTS

Applicant appreciates the consideration shown by the Office, as evidenced by the Office Action mailed on 13 February 2006. In that Office Action, the Examiner rejected claims 20, 22-36, 68-76, and 79-81. After consideration of the Office Action, claims 20 and 68 have been amended, claims 22, 24, 69, and 79 have been canceled, and claim 82 had been added. Claims 1-19, 21, 37-67, and 77-78 had previously been canceled. Claims 20, 23, 25-36, 68, 70-76, and 80-82 are under consideration. Applicant respectfully requests reconsideration of the application by the Examiner in light of the above amendments and the following remarks.

EP077 – claims 20 and 22-35

Claims 20 and 22-35 were rejected under 35 USC 102(b) over EP1054077 (EP077). Claim 20 has been amended to include some of the subject matter of canceled claims 22 and 24.

> 20. A turbine engine component, comprising:
> a substrate;
> a diffusion-controlling layer affixed to the substrate, wherein the **diffusion-controlling layer includes a material selected from the group consisting of Nb, Hf, Ta, and Zr**; and
> an erosion resistant protective structure affixed to the diffusion-controlling layer, wherein the erosion resistant protective structure comprises a shape memory alloy, wherein **the shape metal alloy comprises a nickel-titanium based alloy**, and wherein **the diffusion-controlling layer does not form brittle or low melting phases due to interaction with the erosion resistant protective structure or the substrate**.

With respect to independent claim 20, Applicant continues to be of the opinion that EP077 does not describe erosion resistance, or avoidance of brittle and low melting phases between the diffusion controlling layer and a substrate and an erosion protective coating comprising a shape memory alloy. However, Applicant has narrowed the claim to more specifically recite a more specific embodiment that combines several material groups (please see the first two bolded sections above).

EP077 appears to describe a titanium article having an environmental protective coating (paragraph 0003) which is also referenced as providing oxidation and corrosion protection and which is illustrated as comprising austenitic steel in one example (paragraph 0009).

Applicant notes that the Examiner cites a paragraph 34 with respect to toughness, ductility and transitions. The cited subject matter appears to relate to EP077 paragraph 0035 which Applicant has copied below for reference:

> The protective coating 20 comprises an austenitic stainless steel alloy coating. An austenitic stainless steel has a face centre cubic structure. It is believed that face centre cubic structures have greater toughness and ductility and improved ductile to brittle transition temperatures compared to the other stainless steel compositions having other structures. Additionally face centre cubic structures are more closely packed compared to the stainless steel compositions having other structures and it is believed that the face centre cubic structures have lower diffusion rates through them compared to the other structures.

Applicant is now reciting an even more specific material: a nickel-titanium based alloy. This material does not appear to be taught or suggested by EP077.

A barrier layer in EP077 between the "titanium alloy article" and the "austenitic steel" is referenced at paragraph 0026 and described in more detail at paragraph 0040:

> The embodiment in figure 3 is substantially the same as that in figure 2 but differs in that a barrier layer 24 is provided between the titanium aluminide turbine blade 10 and the protective coating 20. The barrier layer 24 comprises silica, titanium nitride, titanium aluminum nitride or alumina. Other suitable barrier layers are aluminum, cobalt, nickel, iron, silicon, niobium and alloys or compounds of these elements. The barrier layer 24 prevents interdiffusion between the titanium aluminide 10 and the protective austenitic stainless steel coating 20 which may result in the formation of undesirable phases at the interface between the titanium aluminide 10 and the protective austenitic stainless steel coating 20.

Although one of Applicant's listed materials of niobium is positioned in the middle of the second string of potential barrier layer materials in EP077, it is not in the context of use with an erosion protective shape metal alloy.

Applicant notes the Response to Arguments section on pages 12-13 of the Office Action:

> With regard to the EP '077 reference, applicant argues EP '077 does not describe a shape memory alloy, erosion resistance, and or avoidance of brittle and/or low melting phases between the diffusion controlling layer and a substrate and an erosion protective coating comprising a shape memory alloy. The argument acknowledges that EP '077 teaches a barrier layer positioned between a titanium alloy structure and an austenitic steel (a shape memory alloy), but concludes that the diffusion barrier layer s not used in the context of erosion protection of a shape memory alloy. However, as like materials are used in a like manner as claimed, the shape memory alloy layer is expected to provide erosion resistance. In fact, as the diffusion barrier layer serves to prevent interdiffusion between the layers that may result in the formation of undesirable phases (paragraph [0040]), the layered structure lends itself to erosion resistance.

Applicant continues to traverse the assertion that austenitic steel is a shape memory alloy, the Office Action interpretation of paragraph 40, and the statement about erosion resistance. Also, as stated above, Applicant has amended independent claim 20 to recite a more specific type of shape memory alloy. Applicant respectfully submits that the combination of features in amended claim 20 is not taught or suggested by EP077.

Accordingly, Applicant respectfully submits that claim 20 and claims 23, and 25-35 which depend therefrom define allowable subject matter over EP077.

<u>EP077 – claims 36, 68-76, and 79</u>

Claims 36, 68-76, and 79 were rejected under 35 USC 103(a) over EP077.

Claim 36 depends from claim 20 which Applicant believes to be in condition for allowance over EP077 regardless of whether particle size is taught or suggested by EP077.

Claim 68 has been amended to include some of the subject matter of canceled claims 69 and 79. Claim 68 now includes diffusion layer description language similar to that of above-discussed claim 20

and is believed to be in condition for allowance over EP077 for that reason. Claims 70-76 each depend from claim 68.

Accordingly, Applicant respectfully submits that claims 36, 68-76, and 79 define allowable subject matter over EP077.

EPO077 and Coulon – claims 36 and 76

Claims 36 and 76 were rejected under 35 USC 103(a) over EP077 and Coulon US4832993. Claims 36 and 76 depend from respective claims 20 and 68 which Applicant believes to be in condition for allowance over EP077 and Coulon regardless of whether particle size is taught or suggested by Coulon.

Gessinger and EP077 – claims 20, 22-31, 36, 68-71, 76, and 79-81

Claims 20, 22-31, 36, 68-71, 76, and 79-81were rejected under 35 USC 102(b) over Gessinger US4380574 in view of EP077. Claim 20 has been amended to include some of the subject matter of canceled claims 22 and 24, and Claim 68 has been amended to include some of the subject matter of canceled claims 69 and 79.

> 20. A turbine engine component, comprising:
> a substrate;
> a diffusion-controlling layer affixed to the substrate, wherein the **diffusion-controlling layer includes a material selected from the group consisting of Nb, Hf, Ta, and Zr**; and
> an erosion resistant protective structure affixed to the diffusion-controlling layer, wherein the erosion resistant protective structure comprises a shape memory alloy, wherein **the shape metal alloy comprises a nickel-titanium based alloy**, and wherein **the diffusion-controlling layer does not form brittle or low melting phases due to interaction with the erosion resistant protective structure or the substrate**.

> 68. An insert for repairing a turbine component, comprising:
> a substrate dimensioned to be inserted into a recess formed in a turbine component; and
> an erosion resistant protective structure formed on a surface of the substrate, the erosion resistant protective structure comprising a shape memory alloy, wherein **the shape metal alloy comprises a nickel-titanium based alloy**; and
> a diffusion-controlling layer intermediate the substrate surface and the shape memory alloy, wherein **the diffusion-controlling layer includes a material selected from the group consisting of Nb, Hf, Ta, and Zr** and **does not form brittle or low melting phases due to interaction with the erosion resistant structure and/or substrate**.

The one and only reference to a diffusion layer in Gessinger is at column 4, lines 48-55:

> A limited diffusion in the boundary zone between the base material 1 and the surface layer 2 is permissible, as long as the layered build-up of the composite material is not impaired thereby. If necessary, an interlayer can be applied beforehand as a diffusion barrier. These considerations are to be taken into account particularly in the last-mentioned coating process

No particular reference to the material, type, or nature of the diffusion layer is provided by Gessinger. Applicant describes the benefits of the claimed layer in paragraphs 37-39 of Applicant's specification.

The Office Action cites EP077 and states

> EP '077 teaches an intermediate (barrier) layer used to further inhibit diffusion between a turbine blade substrate and a outer protective coating wherein the intermediate layer can be selected from a wide variety of metals (including niobium), nitrides, and oxygen-containing compounds such as silica (line 56 in column 4 to line 11 in column 5). Therefore, as EP'077 clearly teaches a diffusion layer comprising elements as claimed provides the advantage of inhibiting diffusion between an alloy and a protective layer, it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to use the diffusion layer taught by EP'077 as the diffusion layer taught by Gessinger et al, Thus the claimed invention as a whole is *prima facie* obvious over the combined teachings of the prior art.

As stated by Applicant above, EP077 appears to describe a titanium article having an environmental protective coating (paragraph 0003) which is also referenced as providing oxidation and corrosion protection and which is illustrated as comprising austenitic steel in one example (paragraph 0009). A barrier layer in EP077 between the "titanium alloy article" and the "austenitic steel" is referenced at paragraph 0026 and described in more detail at paragraph 0040:

> The embodiment in figure 3 is substantially the same as that in figure 2 but differs in that a barrier layer 24 is provided between the titanium aluminide turbine blade 10 and the protective coating 20. The barrier layer 24 comprises silica, titanium nitride, titanium aluminum nitride or alumina. Other suitable barrier layers are aluminum, cobalt, nickel, iron, silicon, niobium and alloys or compounds of these elements. The barrier layer 24 prevents interdiffusion between the titanium aluminide 10 and the protective austenitic stainless steel coating 20 which may result in the formation of undesirable phases at the interface between the titanium aluminide 10 and the protective austenitic stainless steel coating 20.

Although one of Applicant's listed materials of niobium is positioned in the middle of the second string of potential barrier layer materials in EP077, it is not in the context of use with an erosion protective shape metal alloy and there is no particular suggestion to use the specifically recited materials in combination. More specifically, Applicant submits that the fact that niobium was listed as a potential material for use between titanium aluminide and an austenitic steel in EP007 does not make it obvious to insert niobium or the other materials recited in claims 20 and 68 between a substrate and a shape memory alloy erosion protective coating comprising a nickel-titanium based alloy.

Claims 23, 25-31, 36, 70-71, 76, and 80-81 all depend from one of claims 20 and 68 and are believed to be in condition for allowance for at least that reason. Accordingly, Applicant respectfully submits that claims 20, 23, 25-31, 36, 68, 70-71, 76, and 80-81 define allowable subject matter over Gessinger and EP077.

Gessinger, EP077, and Sue – claims 36 and 76

Claims 36 and 76 were rejected under 35 USC 103(a) over Gessinger, EP077, and Sue US4380574. Claims 36 and 76 depend from respective claims 20 and 68 which Applicant believes to be in condition for allowance over Gessinger and EP077 regardless of whether particle size is taught or suggested by Sue.

Gessinger, EP077, and Gowda – Claims 80-81

Claims 80-81 were rejected under 35 USC 103(a) over Gessinger and EP077 in view of Gowda US7093423. Claims 80 and 81 depend from claim 20 which Applicant believes to be in condition for allowance over Gessinger and EP077 regardless of whether Gowda describes that NiTiFe is a shape memory alloy material.

Claim 82

Claim 82 is a new claim that depends from claim 20 and is believed to be in condition for allowance over the applied art for the reasons discussed above.

Summary

Should the Examiner believe that anything further is needed to place the application in better condition for allowance, the Examiner is requested to contact applicant's undersigned representative at the telephone number below.

Respectfully submitted,

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